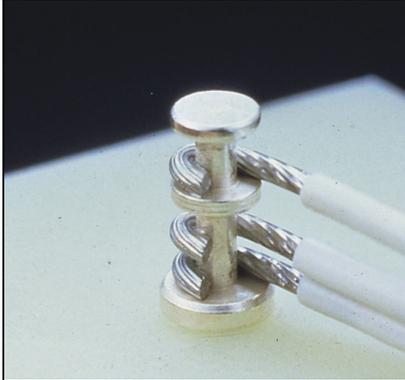


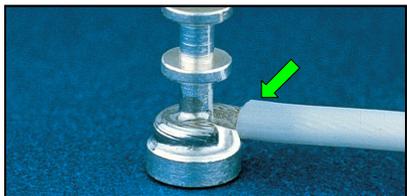
**THROUGH-HOLE SOLDERING  
TERMINALS**



TERMINALS

The proper installation and soldering of wires and component leads to terminals is important to the overall electrical and mechanical reliability of the termination. Particular attention should be paid to routing and stress relief.

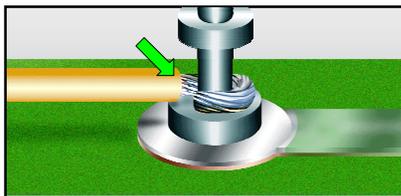
See Section 6.01 "Through-Hole Soldering, General Requirements", for common accept / reject criteria.



**GENERAL REQUIREMENTS  
INSULATION GAP**

The insulation gap (referenced from the first point of contact of the conductor to the terminal) shall be less than two (2) wire diameters, but shall not be imbedded in the solder joint. The wire contour shall be visible at the end of the insulation.

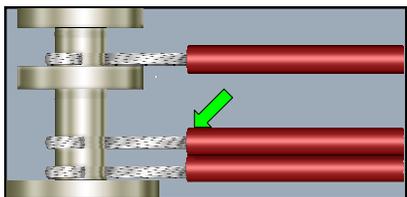
[NASA-STD-8739.3 \[ 9.1.1 \], \[ 9.1.2 \]](#)



**GENERAL REQUIREMENTS  
INSULATION GAP (SPECIAL EXCEPTION)**

When characteristic impedance or other circuit parameters may be affected (i.e.: high-voltage, high-frequency terminations, etc.), the insulation clearance requirements may be modified. All variations shall be documented.

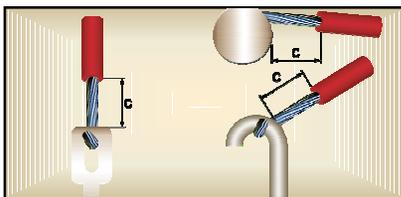
[NASA-STD-8739.3 \[ 9.1.4 \]](#)



**GENERAL REQUIREMENTS  
INSULATION GAP  
MULTIPLE TERMINATIONS**

Conductor insulation clearances are not required to be equal for applications involving the termination of multiple (common) conductors to a terminal in parallel orientation.

[NASA-STD-8739.3 \[ 9.1.3 \]](#)



**UNACCEPTABLE  
IMPROPER INSULATION GAP (C)**

The insulation gap (referenced from the first point of contact of the conductor to the terminal) is greater than two (2) wire diameters. Excessive insulation gap may present a birdcaging or shorting risk.

[NASA-STD-8739.3 \[ 13.6.2.a.2 \]](#)

**NASA WORKMANSHIP STANDARDS**



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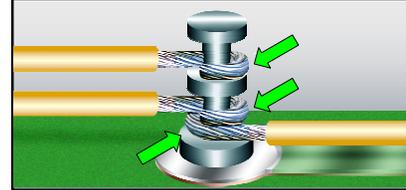
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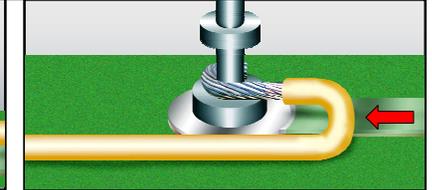
**THROUGH-HOLE SOLDERING  
TERMINALS (cont.)**



**GENERAL REQUIREMENTS  
WRAP ORIENTATION**

Conductors may be wrapped clockwise (CW) or counterclockwise (CCW) to the terminal, but the curvature of dress shall be such that the wrap will tighten against the terminal if the conductor is pulled.

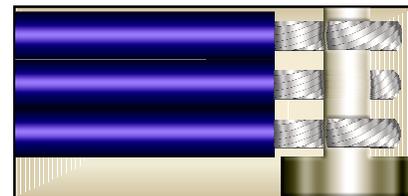
[NASA-STD-8739.3 \[ 9.1.8 \]](#)



**UNACCEPTABLE  
IMPROPER WRAP ORIENTATION**

The conductor's curvature and direction of dress are improper, and the wrap will loosen against the terminal if the conductor is pulled. This will eventually weaken the solder joint.

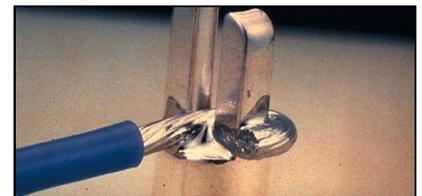
[NASA-STD-8739.3 \[ 13.6.2.a.10 \]](#)



**PREFERRED  
BIFURCATED TERMINALS**

Conductors shall enter the slot, perpendicular to the posts, and make positive contact with at least one post corner. Wires shall be placed in ascending order, with largest on the bottom, and wrap directions shall alternate.

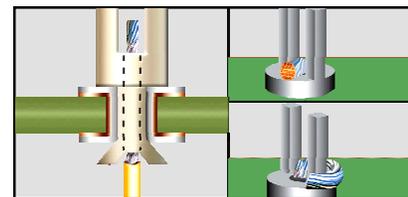
[NASA-STD-8739.3 \[ 9.3.2 \]](#)



**PREFERRED  
BIFURCATED TERMINALS  
SOLDERED ASSEMBLY**

The lead profile is discernible, with wire and terminal interface completely wetted. The solder is smooth and shiny, and fillets the entire wire/lead and terminal interface.

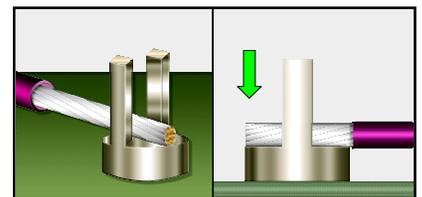
[NASA-STD-8739.3 \[ 10.2.2 \], \[ 13.6.1 \]](#)



**ACCEPTABLE  
BIFURCATED TERMINALS  
BOTTOM ROUTE**

The uninsulated conductor end shall enter the terminal from the bottom, be brought through one of the side slots at the top, and wrapped as required for a side route termination.

[NASA-STD-8739.3 \[ 9.3.3 \]](#)



**ACCEPTABLE  
BIFURCATED TERMINALS  
STRAIGHT-THROUGH TERMINATION**

Single conductors may be terminated straight-through, providing the conductor is in contact with the base, exhibits proper insulation clearance, and has no end overhang.

[NASA-STD-8739.3 \[ 9.3.2 \]](#)

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**THROUGH-HOLE SOLDERING  
TERMINALS (cont.)**

**ACCEPTABLE BIFURCATED TERMINALS TOP TERMINATION**

The conductor is in contact with both posts. Any space between the posts has been filled with filler wire or by doubling. **Top termination is not recommended for flight hardware.**

*Best Workmanship Practice*

**UNACCEPTABLE BIFURCATED TERMINALS TOP ENTRY - PARTIAL FILL**

The top route termination has unfilled space between the posts and the conductor, and no filler wire or doubling has been used to fill the gap.

*Best Workmanship Practice*

**ACCEPTABLE BIFURCATED TERMINALS WRAP DIRECTION**

When multiple conductors are connected to a terminal, the direction of bend of each additional conductor shall alternate and the termination shall alternate posts.

[NASA-STD-8739.3 \[ 9.3.2 \]](#)

**UNACCEPTABLE BIFURCATED TERMINALS END TAIL OVERHANG**

The end tail shall not extend beyond the diameter of the terminal base, except when physical clearance is adequate. End tail overhang may violate minimum electrical clearance.

[NASA-STD-8739.3 \[ 9.3 \]](#), [ 13.6.2.a.10 ]

**PREFERRED HOOK TERMINALS**

The conductor is wrapped in full contact with the terminal for a minimum of 180° and a maximum of 270°, and is attached to the hook within the 180° arc. Insulation clearance is less than one (1) wire diameter, and wire end does not protrude.

[NASA-STD-8739.3 \[ 9.1 \]](#), [ 9.4 ]

**PREFERRED HOOK TERMINALS COMPLETED ASSEMBLY**

The lead profile is discernible, with wire and terminal interface completely wetted. The solder is smooth and shiny, and fillets the entire wire/lead and terminal interface.

[NASA-STD-8739.3 \[ 13.6.1. \]](#)

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**THROUGH-HOLE SOLDERING  
TERMINALS (cont.)**

**GENERAL REQUIREMENTS INSULATION SLEEVING**

Sleeving shall completely cover and fit snugly around the terminal and the wire insulation, and overlap the wire insulation by a minimum of 5 mm (0.20 in.), or two (2) insulated wire diameters, whichever is larger.

[NASA-STD-8739.3 \[ 9.8 \]](#)

**UNACCEPTABLE IMPROPER INSULATION SLEEVING**

The sleeving shall not be pierced, split, charred, or otherwise damaged, and shall completely cover the terminal and overlap the wire insulation. The sleeving shall fit snugly around the terminal and the wire insulation.

[NASA-STD-8739.3 \[ 9.8 \]](#)

**GENERAL REQUIREMENTS TERMINAL FILL**

Conductors shall be in full contact with the terminal and each other. They shall be mounted as close to the base as allowed by the insulation or body shape, and not wrapped onto each other or extend beyond the top of the terminal.

[NASA-STD-8739.3 \[ 9.1.9 \]](#)

**UNACCEPTABLE EXCESSIVE CONDUCTOR FILL**

The number of conductors shall not exceed the capacity of the terminal post. Conductors shall not extend above the top of the terminal post.

*Best Workmanship Practice*

**GENERAL REQUIREMENTS SERVICE LOOPS / STRESS RELIEF**

Wire / harness terminations shall exhibit an even distribution of conductor dress and tension throughout the cable and harness, to prevent stress to the terminations.

[NASA-STD-8739.3 \[ 9.1.5 \]](#), [ 9.1.7 ]

[\[ 13.6.1.h \]](#)  
[NASA-STD-8739.4 \[ 4.3.5.c \]](#), [ 19.6.1.e.3 ]

**UNACCEPTABLE INSUFFICIENT SERVICE LOOP**

The termination exhibits an uneven dress length of individual conductors, which may result in a concentration of stress on a single conductor.

[NASA-STD-8739.3 \[ 13.6.2.a.10 \]](#), [ 13.6.2.a.17 ]  
[NASA-STD-8739.4 \[ 4.3.5.c \]](#)

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**THROUGH-HOLE SOLDERING  
TERMINALS (cont.)**

**ACCEPTABLE  
HOOK TERMINALS - WRAP LOCATIONS**

The conductor(s) are wrapped in full contact for a minimum of 180°. Wraps alternate direction and do not overlap. Terminations are located more than one wire diameter from hook end, with majority located within the 180° arc (hook).

[NASA-STD-8739.3 \[ 9.4 \]](#)

**UNACCEPTABLE  
HOOK TERMINALS  
IMPROPER WRAP LOCATION**

The termination is not located in the 180° arc of the terminal, with the wrap located less than one wire diameter from the hook end.

[NASA-STD-8739.3 \[ 9.4 \], \[ 13.6.2.a.10 \]](#)

**PREFERRED  
PIERCED / PERFORATED TERMINAL**

The wire passes through the eye of the terminal, is wrapped in contact with both sides of the terminal, and does not overhang the terminal edge. Insulation clearance is less than 1 wire diameter.

[NASA-STD-8739.3 \[ 9.5 \]](#)

**PREFERRED  
PIERCED / PERFORATED TERMINAL  
SOLDERED ASSEMBLY**

The lead profile is discernible, with wire and terminal interface completely wetted. The solder is smooth and shiny, and fillets the entire wire/lead and terminal interface.

[NASA-STD-8739.3 \[ 13.6.1 \]](#)

**ACCEPTABLE  
PIERCED / PERFORATED TERMINAL  
SIDE ENTRY**

The wire passes through the terminal eye, and exhibits a quarter turn (90°) wrap in contact with the terminal face. Termination exhibits proper insulation clearance (C).

[NASA-STD-8739.3 \[ 9.5 \]](#)

**ACCEPTABLE  
PIERCED / PERFORATED TERMINAL  
ZIG-ZAG TERMINATION**

The wire passes through the terminal eye and exhibits two (2) quarter turn (90°) zig-zag wraps in contact with both terminal sides. Termination exhibits proper insulation clearance (C).

[NASA-STD-8739.3 \[ 9.5 \]](#)

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**THROUGH-HOLE SOLDERING  
TERMINALS (cont.)**

**MANDATORY  
TURRET TERMINAL WRAP  
CONDUCTOR SIZES ≤ AWG 26**

Conductor sizes AWG 26 and smaller shall be wrapped a minimum of ½ turn (180°), but less than one (1) full turn (360°) around the post.

[NASA-STD-8739.3 \[ 9.2.1.b \]](#)

**MANDATORY  
TURRET TERMINAL WRAP  
CONDUCTOR SIZES > AWG 26**

Conductor sizes larger than AWG 26 shall be wrapped a minimum of ½ turn (180°), to a maximum of ¾ turn (270°) around the post.

[NASA-STD-8739.3 \[ 9.2.1.a \]](#)

**UNACCEPTABLE  
TURRET TERMINALS  
IMPROPER WRAP**

Conductors and part leads shall be mounted as close to the terminal base, as allowed by the insulation or body shape, and shall be in full contact with the terminal and each other.

[NASA-STD-8739.3 \[ 9.1 \], \[ 13.6.2.a.10 \]](#)

**UNACCEPTABLE  
TURRET TERMINALS  
TOP MOUNTING**

Components shall be mounted parallel and in contact with the mounting surface, unless specified otherwise in the engineering documentation.

[NASA-STD-8739.3 \[ 8.3.1 \], \[ 13.6.2.a.5 \]](#)

**SPECIAL APPLICATIONS  
CONTINUOUS RUN CONNECTIONS  
BIFURCATED TERMINALS**

The wire shall pass between each set of terminal posts, contact each terminal base, and exhibit stress relief. The wire ends shall be attached to the first and last terminal with a 90° to 180° wrap.

[NASA-STD-8739.3 \[ 9.3.4 \]](#)

**SPECIAL APPLICATIONS  
PIGGYBACKED / STACKED COMPONENTS**

Multiple discrete components may be terminated in a piggybacked / stacked configuration, with the largest component mounted parallel to and in contact with the mounting surface. All components shall be stress-relieved and staked.

[Best Workmanship Practice](#)

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**THROUGH-HOLE SOLDERING  
TERMINALS (cont.)**

**SPECIAL APPLICATIONS  
CONTINUOUS RUN CONNECTIONS  
PIERCED / PERFORATED TERMINALS**

The wire shall pass through each terminal eye, contacting both sides of each terminal, exhibit stress relief, and shall be terminated to the first and last terminal with a 90° to 180° wrap.  
[Best Workmanship Practice](#)

**UNACCEPTABLE  
CONTINUOUS RUN CONNECTIONS  
PIERCED / PERFORATED TERMINALS**

The wire passes through each terminal eye, but does not contact both sides of each terminal.  
[Best Workmanship Practice](#)

**SPECIAL APPLICATIONS  
CONTINUOUS RUN CONNECTIONS  
TURRET TERMINALS**

The wire shall wrap around each terminal, contact each terminal base, exhibit stress relief, and be terminated to the first and last terminal with a 180° to 270° wrap (depending on wire gauge).  
[NASA-STD-8739.3 \[ 9.2.3 \]](#)

**UNACCEPTABLE  
CONTINUOUS RUN CONNECTIONS  
TURRET TERMINALS**

The wire does not wrap 360° around each inner terminal or exhibit sufficient stress relief.  
[NASA-STD-8739.3 \[ 9.2.3 \]](#)

**THROUGH-HOLE SOLDERING  
TERMINALS (cont.)**

**UNACCEPTABLE  
PIERCED / PERFORATED TERMINAL  
SIDE ENTRY**

The wire passes through the terminal eye, but exhibits a wrap that is less than 90° and which is not in contact with the terminal face.  
[NASA-STD-8739.3 \[ 9.5 \]](#), [ 13.6.2.a.10 ]

**UNACCEPTABLE  
PIERCED / PERFORATED TERMINAL  
SIDE ENTRY**

The wire passes through the terminal eye, and exhibits a quarter turn (90°) wrap in contact with the terminal face, extending over the terminal edge.  
[NASA-STD-8739.3 \[ 9.5 \]](#), [ 13.6.2.a.10 ]

**PREFERRED  
TURRET TERMINAL**

The conductors are parallel to each other and to the mounting base. Conductors are mechanically secure, wrapped a minimum of 180° to 360°, non-overlapping, with the first conductor in contact with the terminal base.  
[NASA-STD-8739.3 \[ 9.2 \]](#)

**PREFERRED  
TURRET TERMINAL  
SOLDERED ASSEMBLY**

The lead profile is discernible, with wire and terminal interface completely wetted. The solder is smooth and shiny, and fillets the entire wire/lead and terminal interface.  
[NASA-STD-8739.3 \[ 10.2.2 \]](#), [ 13.6.1 ]

**ACCEPTABLE  
TURRET TERMINAL**

Conductors have been mechanically secured to the terminal with a minimum of 180° wraps. Multiple conductors may be installed in a single slot, if wrapped to the post without overlap.  
[NASA-STD-8739.3 \[ 9.2.1 \]](#)

**ACCEPTABLE  
TURRET TERMINALS  
BOTTOM ROUTE**

The uninsulated conductor end shall enter the terminal from the bottom, be brought through the side slot at the top, and wrapped as required for a side route termination.  
[NASA-STD-8739.3 \[ 9.2.2 \]](#)

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